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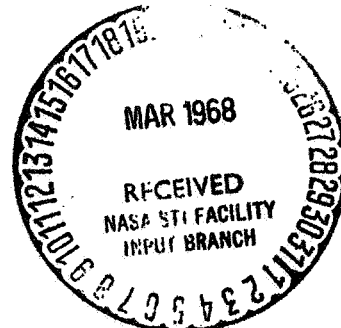
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SEMIANNUAL RESEARCH REPORT ON GRANT NsG-603

Organic and Metallo-organic Laser Materials

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N 68 - 83455



This report covers the period July 1 through December 31, 1967. During these six months progress has been made along several direction of research.

1. Sensitized Lanthanide Fluorescence, A New Kind of Terbium Laser. The investigation of rare earth ions fluorescence excited by absorption of pumping light in a non-associated organic molecule (sensitizer) has continued. The quantum efficiency measurements, the influence of solvent nature, viscosity, and temperature have led to the selection of several sensitizer-lanthanide ion combinations for testing as liquid laser materials. A terbium-1,10-phenanthroline composition has been flashed in the laser cavity at Goddard and exhibited obvious line narrowing at 5470 \AA in the green. There are a few unique features associated with this new laser. It is very interesting that the sensitizer : Tb^{3+} ion ratio was 1:10. This translates itself into the possibility of using larger diameter cavity (less organic absorption) and suggests the possible use of an intense, high power completely inorganic Tb liquid laser. This line of study will be continued in 1968.

2. Theoretical work in Rare Earth Chelates. The study of energy transfer process and emission spectra in lanthanide ion chelates has been productive. Important new ways to establish molecular structure and mutual orientation of particles from emission spectra have been developed. These theoretical interpretations leading to calculations of molecular parameters have proved to be a very powerful tool. Three articles on the subject have been accepted for publication (see 4. Publications).

3 pages
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3. Organic Laser Materials. Sharp-line stimulated emission has been obtained from purely organic materials in the liquid laser cavity, in solution at room temperature. Up to 15 different emission lines a few ["]Ångströms wide were detected for several compounds. The phenomenon is quite complicated but so unique, that at present this report will only give a general information. A great deal of effort is going toward the elucidation of this very unusual finding. Some progress has already been made.

4. Publications. Five articles have been accepted for publication in leading journals during the second half of 1967. They will be printed during the early part of 1968. Following are the titles, the journals where they have been submitted and accepted, and the authors:

[1] "On the Photoreduction of Benzophenone in Isopropyl Alcohol" - JOURNAL OF THE AMERICAN CHEMICAL SOCIETY (scheduled for print in the March 1968 issue). N. Filipescu and F. L. Minn.

[2] "Correlation of Molecular Structure with Fluorescence Spectra in Tetraethylammonium tetrakis(dibenzoylmethido) europate(III)". JOURNAL OF PHYSICAL CHEMISTRY (to be printed in the February 1968 issue), S. Bjorklund, N. Filipescu, N. McAvoy, and J. J. Degnan.

[3] "Analysis of Fluorescence Spectra of Rare Earth chelates-II Internal Stark Splitting in Dipyriddy complexes of Europic Chloride". - JOURNAL OF CHEMICAL PHYSICS - N. Filipescu, S. Bjorklund, N. McAvoy, and J. J. Degnan.

[4] "Stimulated Emission and Laser Action From the Organic Ligand of Gadolinium Chelates". - NATURE - N. Filipescu, N. McAvoy, and C. R. Hurt.

[5] "Organic Cation Effects on the Internal Stark Splitting in the Fluorescence Spectra of Tetrakis(dibenzoylmethido)europates(III)". - JOURNAL OF THE CHEMICAL SOCIETY (London) - N. Filipescu, J. J. Degnan, and N. McAvoy. Reprints of the above articles will be submitted during 1968.

During the last six months of 1967, one paper has been published in the Journal of Scientific Instruments. [REDACTED]

Two other manuscripts on the subject of sensitized lanthanide fluorescence and a new kind of terbium laser are in preparation.

During the period reported herein, the Principal Investigator worked part time, two graduate students (Research Assistants) full time and one other student part time.